LANDSCAPE PLANNING POSSIBILITIES FOR “KORIATA” SAND AND GRAVEL QUARRY, SOFIA REGION, BULGARIA

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Abstract: The paper presents results of landscape planning and investigation on Fluvisols. The object is “Koriata” sand and gravel quarry, Bulgaria. Soil samples were taken from seventeen soil profiles at a depth of 0-20 cm, 20-40 cm, 40-60 cm, 60-80 cm, and 80-100 cm. There were significant correlations between the physical and chemical soil properties in 40 out of 48 cases. Statistically significant high correlation coefficients ($> \pm 0.6$) have been calculated: for example, there is a negative correlation between bulk density on the one hand and soil organic matter (SOM) and nutrients on the other; there is a high positive correlation between total porosity and SOM and nutrients. The correlations between the clay fraction and SOM, total Kjeldahl nitrogen (TKN) and K_2O are also high. Formulating a landscape plan for the territory of “Koriata” sand and gravel quarry will improve the quality of life of residents, will result in at least a sevenfold increase in plant diversity and will meet the demand for themed waterparks within the city limits of Sofia.

Key words: landscape planing, Fluvisols, quarry, physical properties, chemical properties, green system.

INTRODUCTION

The emergence and development of green urban systems is linked to the industrial revolution and the urban sprawl typical of the 19th and 20th centuries. The ever increasing urban expansion eating up large areas of land creates the need for a harmonious relationship between gardens and parks in the urban environment and the surrounding natural environment.

Urban ecology has had a long history mainly in Europe and has developed rapidly over the last few decades. There is a lot of evidence that urban territories bring about significant environmental changes, and people are the main driver of change. This has led to the idea that the city is a “socioecosystem”, and the improvement of the quality of life is related to improvements in the ecological and social parameters of the city [1; 2; 3; 4; 5]. Different ecosystems develop as a result of the interactions between organisms and their responses to geological, topographic, hydrological and climatic conditions. An interruption of these conditions may have serious consequences for habitats [6]. A number of plant species are closely related to soil properties by influencing plant development, or by indicating changes in the soil substrate [7; 8; 9; 10].

Unlike other anthropogenic sources of contamination, quarries and ballasters are a source of coarse and fine particles [11]. The soils close to mining sites are characterized by high bulk density, low pH, low humus content, poor texture and poor hydro-physical properties [12; 13; 14; 15; 16]. The sand and gravel quarries are located in the area of distribution of soils from the Fluvisols soil group [17; 18]. Fluvisols are intrazonal and occur in the riverside environment [19]. They are characterized by favourable water regime [20; 19; 18] and good bulk density [21; 18]. Soil organic matter (SOM) is average or low [18], but varies strongly [22] and

may reach up to 2% in the surface horizon [23]. The nitrogen content is low [18] to average to high [24]. Favorable water, air indicate that these soils have been used for agriculture since ancient times. The soils are characterized by a low store of nutrient elements. [25]. These soils can be used for growing of high yield cultures if fertilized properly [19; 26]. Fluvisols are found between Chernozems and Gray forest soils in Northern Bulgaria, along the rivers - Danube, Lom, Ogosta, Iskar, Osam, Yantra, Rositsa and Kamchia [27; 28]. In Southern Bulgaria they are situated between Vertisols and Cinnamonic Forest soils [29; 19]. A main soil-forming factor is the nature of the alluvial deposit [30], which differs depending on the adjacent water basin that has carried the deposits, on the location along the river, and on the distance from the water. The weather conditions are determined by the climate zone of the respective river valley [19].

The right choice of plant genotypes which have the proper structure and function to deal effectively with a particular problem is an important step in the planning of environmental engineering activities due to the fact that a number of essential aspects have to be evaluated in order to maximize the effectiveness of each activity [31].

MATERIALS AND METHODS

The object. Fluvisols [32] occurring on the territory of “Koriata” sand and gravel quarry (so far unexploited), located next to Vrazhdebna District, Sofia, Bulgaria were the target of the study. Usually this soil type is found in the Lower forest vegetation zone (0 - 600 m a. s. l.) [33]. **The climate** has a direct influence on the temperature and moisture of the soil, and an indirect one on the biota. In terms of climate, the subject of study falls within the European

continental climatic region, temperate continental sub-region, climatic region of the high fields of Mid-Western Bulgaria [34]. The average temperatures in January are about 4 – 5 °C, and the average temperatures in June are 20 – 21 °C. The average annual temperature of the studied area varies around 11.5°C, the average annual rainfall varies around 837 mm, with a peak rainfall in May and a minimum in July [34].

Methods of study. Seventeen soil profiles were dug at representative plots. A systematic sampling design was used [35]. The samples were taken at a depth of 0-20 cm, 20-40 cm, 40-60 cm, 60-80 cm and 80-100 cm.

The following soil characteristics were analyzed by using the respective methods: Bulk density (BD, g.cm^{-3}), according to the DIN ISO 11272:1998, 2001 [36]; Total porosity (TP, %) by calculating bulk density and relative density [37]; Soil texture (Sand - 2 mm - 63 μm , %; Silt - 63 μm - 2 μm , %; Clay < 2 μm , %), using the sedimentation method [38]; Plant available water capacity (PAWC, mm), by a laboratory method, with the calculation of field capacity and permanent wilting point [39]; Soil acidity (pH in water extraction) – measured potentiometrically by WTW 720 pH meter [40]; Soil organic matter (SOM, %) by ISO 14235:1998 [41]; Total Kjeldahl Nitrogen (TKN, %) content, with a modified version of the classic Kjeldahl method [42]; P_2O_5 (mg.100g^{-1}) – extraction with Ammonium Acetate and Calcium Lactate-pH 4.2 (UV-VIS spectrophotometer Perkin Elmer Lambda 5) [43]; K_2O (mg.100g^{-1}) – extraction with Ammonium

Acetate and Calcium Lactate-pH 4.2 (Flame photometer Jenway php 7) [43].

Data analysis. Descriptive statistics was done using Numbers and Excel on Mac and PC, respectively. Percentage data were arcsine-square root transformed before the analysis [44]. Pearson's product-moment correlation among the soil characteristics studied was calculated using SPSS for Windows, version 16.0.

RESULTS AND DISCUSSION

Soil characteristics. The soil texture varies with depth ranging from sandy clay loam to loam (Fig.1) in the two surface layers (0-20 and 20-40 cm), and within the sandy loam class at the other depths (40-60, 60-80, 80-100 cm) with the decrease in the clay fraction (Table 1).

Fig. 1. Soil texture [45]

Table 1. Physical and chemical properties

Depth, cm	n	BD, g.cm ⁻³	TP, %	Sand, %	Silt, %	Clay, %	PAWC, mm	pH (H ₂ O)	SOM, %	TKN, %	P ₂ O ₅ , mg.100g ⁻¹	K ₂ O, mg.100g ⁻¹	
0-20	17	Min	1,17	50,07	48,49	25,75	16,89	-	5,78	3,15	0,019	1,93	2,33
		Max	1,43	65,94	54,24	29,92	24,43	-	6,26	3,85	0,026	2,68	3,04
		Mean	1,25	58,78	51,26	27,63	21,11	-	6,04	3,48	0,023	2,25	2,67
		SD ¹	0,08	5,09	1,77	1,27	2,00	-	0,13	0,25	0,002	0,22	0,20
		CV ²	0,06	0,09	0,03	0,05	0,09	-	0,02	0,07	0,098	0,10	0,08
20-40	17	Min	1,22	48,52	48,16	25,07	15,81	-	5,54	2,06	0,010	0,96	1,16
		Max	1,50	57,58	54,70	29,91	23,65	-	6,48	2,85	0,016	1,31	1,91
		Mean	1,35	52,54	51,44	27,87	20,69	-	6,01	2,44	0,013	1,15	1,56
		SD ¹	0,10	3,11	2,16	1,73	2,61	-	0,30	0,26	0,002	0,11	0,24
		CV ²	0,07	0,06	0,04	0,06	0,13	-	0,05	0,11	0,174	0,09	0,16
40-60	17	Min	1,27	44,76	51,98	25,23	13,92	152,97*	5,60	1,37	0,010	0,17	1,07
		Max	1,54	54,56	59,94	26,65	22,10	195,87*	6,63	1,97	0,015	0,33	1,59
		Mean	1,39	49,77	55,23	25,91	18,86	175,11*	6,01	1,66	0,012	0,27	1,37
		SD ¹	0,09	2,93	2,60	0,42	2,66	14,45*	0,31	0,21	0,002	0,05	0,18
		CV ²	0,07	0,06	0,05	0,02	0,14	0,08*	0,05	0,13	0,152	0,18	0,13

60-80	17	Min	1,31	43,02	50,07	27,07	11,45	-	5,27	0,19	0,008	0,05	0,69
		Max	1,60	51,23	59,84	30,00	21,20	-	6,01	0,44	0,011	0,09	1,06
		Mean	1,44	48,29	55,22	28,77	16,01	-	5,64	0,34	0,009	0,07	0,92
		SD ¹	0,11	2,18	3,03	0,88	3,27	-	0,26	0,08	0,001	0,01	0,12
		CV ²	0,08	0,05	0,05	0,03	0,20	-	0,05	0,24	0,106	0,20	0,13
80-100	17	Min	1,39	38,20	55,18	30,05	4,40	-	5,33	0,19	0,006	0,04	0,65
		Max	1,64	48,70	61,96	34,86	13,78	-	6,77	0,33	0,008	0,06	0,85
		Mean	1,50	43,08	58,85	31,95	9,20	-	6,03	0,26	0,007	0,05	0,76
		SD ¹	0,09	3,23	2,23	1,54	2,58	-	0,57	0,05	0,001	0,01	0,06
		CV ²	0,06	0,07	0,04	0,05	0,28	-	0,09	0,19	0,114	0,15	0,08

Legend: * Applies to the whole soil profile; ¹ SD – standart deviation; ² CV - coefficient of variation

In terms of bulk density, the soils range from moderately compacted to averagely compacted (0-20 cm), within the averagely compacted class (20-40 cm), from averagely compacted to highly compacted (in the layers at a depth of 40-60, 60-80, 80-100 cm) (according to the classification of AG Bodenkunde [46]).

Total porosity ranges from averagely porous to highly porous in the 0-20 cm layer, from averagely porous to moderately porous (in the 20-40 and 40-60 cm layers), within the averagely porous class for the 60-80 cm layer and from slightly porous to averagely porous for the 80-100 cm layer (according to the classification of AG Bodenkunde [46]).

According to Dilkova's classification [47] PAWC ranges from medium to high.

Soil acidity ranges from moderately acidic to slightly acidic in the 0-20, 20-40 cm and 60-80 layers, from moderately acidic to very slightly acidic in the 40-60 cm and 80-100 cm layers according to von H.-P. Blume [48].

Soil organic matter varies within the low SOM content class in the 0-20 and 20-40 cm layers, within the very low SOM content class in the 40-60 cm layer and within the no SOM content class in the 60-80 and 80-100 cm layers according to AG Bodenkunde [46].

The nitrogen content is within the very low availability class in all layers according to Penkov's

classification [49].

The assimilable phosphorus content ranges from good availability to very good availability in the surface layer, from medium availability to good availability in the 20-40 cm layer, and decreases to low availability in the other layers (according to Penkov's classification [49]).

The assimilable potassium content ranges from good availability to very good availability in the 0-20 cm layer, from medium availability to good availability in the 20-40 cm layer, from low availability to medium availability in the 40-60 cm layer, from very low availability to low availability in the 60-80 cm layer and within the very low availability class in the 80-100 cm layer according to Penkov [49].

There are some interesting high correlations ($> \pm 0.6$) which are shown in Table 2. There is a negative correlation between bulk density on the one hand and SOM and nutrients on the other, which is most likely due to the fact that SOM is characterized by low bulk density and that the decomposition of organic matter releases nitrogen and ash elements (whose correlation coefficient for the studied soils is over 0.8). There is a high correlation between total porosity on the one hand and SOM and nutrients on the other (which is most likely due to the abovementioned correlations).

Table 2. Correlation matrix

	BD, g.cm ⁻³	TP, %	Sand, %	Silt, %	Clay, %	pH (H ₂ O)	SOM, %	TKN, %	P ₂ O ₅ , mg.100g ⁻¹
TP, %	-0,558*	-	-	-	-	-	-	-	-
Sand, %	0,520*	-0,578*	-	-	-	-	-	-	-
Silt, %	0,393*	-0,446*	0,406*	-	-	-	-	-	-
Clay, %	-0,555*	0,622*	-0,907*	-0,753*	-	-	-	-	-
pH (H ₂ O)	-0,233*	0,103	-0,167	-0,006	0,123	-	-	-	-
SOM, %	-0,642*	0,795*	-0,678*	-0,502*	0,720*	0,218	-	-	-
TKN, %	-0,649*	0,798*	-0,603*	-0,419*	0,627*	0,119	0,879*	-	-
P ₂ O ₅ , mg.100g ⁻¹	-0,629*	0,781*	-0,626*	-0,294*	0,586*	0,181	0,923*	0,902*	-
K ₂ O, mg.100g ⁻¹	-0,652*	0,799*	-0,621*	-0,444*	0,652*	0,162	0,925*	0,928*	0,925*

* Correlation is significant at the 0,01 level

There is a high negative correlation between the sand fraction on the one hand and SOM and nutrients on the other, which is most likely related to the nature of the soil formation process in these soils, the accumulation and decomposition of organic matter. There is a very high negative correlation between the sand and clay fractions, which can be explained by the low weathering rates of the parent material and the periodic deposition of new parent material (which can also explain the high correlation between the silt and clay fractions). The nature of the formation of the clay fraction is perhaps the most likely reason for its high correlation to SOM, TKN and K_2O .

Plant cover

Higher plants are the most significant *biotic* factors that shape the formation of soils, microclimate, supply the soil with organic matter and influence its composition and properties [50]. The soils have been formed under poorly developed meadow vegetation [51; 52; 50]. The study on Fluvisols in the Sofia hollow showed that the most numerous families are Asteraceae, Poaceae [17; 18] and Rosaceae [17]. Many families are represented by a single species. Euro-Asiatic floristic elements form the most numerous group of species phytogeographic origin, followed by Cosmopolitan elements, European and Euro-Mediterranean elements [17; 18]. The natural vegetation occurring on the site is represented by ruderal species (*Mentha spicata* L., *Tripleurospermum inodorum* (L.) Sch.Bip., *Vicia sativa* L., *Plantago lanceolata* L., *Trifolium pretense* L., *Teucrium chamaedrys* L., *Cirsium arvense* Scop., *Lepidium campestre* (L.) W.T.Aiton, *Xanthium strumarium* L., *Geranium pusillum* L., *Medicago lupulina* L., *Plantago media*

L., *Malva sylvestris* L., *Setaria viridis* (L.) P.Beauv., *Artemisia vulgaris* L., *Convolvulus arvensis* L.).

Landscape planning. Studies show that the urban population thinks that the primary function of green areas is ecological and their secondary functions are social and recreational. One of the main reasons for visiting public green areas is passive recreation in an environment with better air quality indicators [53]. Fuller et al. [54] identified relationships between biodiversity, area and psychological well-being using linear regression models. The number of plant species has a far greater impact on the psychological well-being than the number of birds.

In his monograph “The Green System of Sofia - Urban Aspects” Kovachev [55] points out that at its current stage the green system of the capital is characterized by an uneven territorial distribution of its elements. There are no large interconnected areas that have an ameliorating effect and create a suitable environment for mass recreation.

Kuleliev [56] emphasizes the lack of themed activities (water areas and attractions, amusements, sports equipment, fun activities for children, etc.) in the green system of Sofia.

The landscaping plans for “Koriata” sand and gravel quarry take into consideration the needs of the residents and visitors of Sofia for water-based theme parks (Fig. 2). The main element of the landscape design project is the water area that provides opportunities for both passive and active recreation. A large children playground has been designed for children of different age groups. The selected species composition is consistent with the soil and climatic characteristics of the site (Table 3).

Fig. 2. Conceptual landscape design for “Koriata” quarry

Table 3. Species composition of the conceptual landscape design for “Koriata” quarry

<i>Ginkgo biloba</i> L. ²	<i>Mafnolia x soulangeana</i> 'Lennei' ²
<i>Abies cephalonica</i> Loud. ²	<i>Mafnolia x soulangeana</i> 'Alexandrina' ²
<i>Cedrus atlantica</i> Manett ²	<i>Magnolia obovata</i> Thunb. ²
<i>Cedrus deodara</i> Loud. ²	<i>Liquidambar styraciflua</i> L. ²
<i>Pinus silvestris</i> L. ²	<i>Platanus orientalis</i> L. ¹
<i>Pinus nigra</i> Arnold ²	<i>Platanos x acerifolia</i> L. ¹
<i>Pinus halepensis</i> Mill ²	<i>Spiraea prunifolia</i> Sieb. Et Zucc. ³
<i>Cupressus sempervirens</i> L. ²	<i>Spiraea cantoniensis</i> Lour. ^{2, 3}
<i>Cupressus arizonica</i> Greene ²	<i>Spiraea japonica</i> L. ^{2, 3}
<i>Chamaecyparis lawsoniana</i> Parl. ²	<i>Spiraea henryi</i> Hemsl. ³
<i>Chamaecyparis lawsoniana</i> 'Glaucua' ²	<i>Spiraea latifolia</i> Borkh. ³
<i>Chamaecyparis lawsoniana</i> 'Pendula' ²	<i>Cotoneaster integerrimus</i> Med.
<i>Chamaecyparis lawsoniana</i> 'Pyramidalis' ²	<i>Pyracantha coccinea</i> Roem. ^{2, 3}
<i>Chamaecyparis pisifera</i> Endl. ²	<i>Kerria japonica</i> DC ^{2, 3}
<i>Chamaecyparis pisifera</i> 'Squarosa' ²	<i>Kerria japonica</i> 'Pleniflora' ^{2, 3}
<i>Chamaecyparis pisifera</i> 'Filifera' ²	<i>Albizia julibrissin</i> Durazz. ²
<i>Chamaecyparis pisifera</i> 'Fififera Aureovariegata' ²	<i>Cercis siliquastrum</i> L. ²
<i>Chamaecyparis pisifera</i> 'Filifera' ²	<i>Robinia pseudoacacia</i> 'Umbraculifera' ²
<i>Chamaecyparis pisifera</i> 'Plumosa' ²	<i>Laburnum anagyroides</i> Medik ²
<i>Chamaecyparis lawsoniana</i> 'Nana' ²	<i>Ailantus altissima</i> Swingle ²
<i>Chamaecyparis lawsoniana</i> 'Minima Glauca' ²	<i>Buxus sempervirens</i> 'Angustifolia' ²
<i>Thuja occidentalis</i> L. ²	<i>Buxus sempervirens</i> 'Argenteo variegata' ²
<i>Thuja occidentalis</i> 'Fastigiata' ²	<i>Buxus sempervirens</i> 'Bullata' ²
<i>Thuja occidentalis</i> 'Aurea' ²	<i>Buxus sempervirens</i> 'Pyramidalis' ²
<i>Thuja occidentalis</i> 'Columnna' ²	<i>Buxus sempervirens</i> 'Rotundifolia' ²
<i>Thuja occidentalis</i> 'Compacta' ²	<i>Buxus sempervirens</i> 'Suffruticosa' ²
<i>Thuja orientalis</i> 'Aurea Nana' ²	<i>Acer platanoides</i> L. ¹
<i>Thuja orientalis</i> 'Compacta' ²	<i>Acer platanoides</i> 'Schwedleri' ^{1, 2}
<i>Thuja orientalis</i> L. ^{2, 3}	<i>Acer platanoides</i> 'Fassens Black' ^{1, 2}
<i>Thuja orientalis</i> 'Meldensis' ²	<i>Acer platanoides</i> 'Drumondii'
<i>Thuja orientalis</i> 'Semperaurea' ²	<i>Acer platanoides</i> 'Globosum'
<i>Thujaops dolabrata</i> Sieb. Et Zucc. ²	<i>Acer saccharinum</i> L. ^{1, 2}
<i>Juniperus communis</i> L. ²	<i>Acer saccharinum</i> 'Palmatum' ^{1, 2}
<i>Juniperus communis</i> var. nana ²	<i>Acer palmatum</i> Thunb. ²
<i>Juniperus oxycedrus</i> L. ²	<i>Acer palmatum</i> 'Atro-Purpureum' ²
<i>Juniperus virginiana</i> L. ²	<i>Aesculus hippocastanum</i> L. ¹
<i>Juniperus virginiana</i> 'Glaucua' ²	<i>Aesculus hippocastanum</i> 'Laciniata' ¹
<i>Populus tremula</i> L. ²	<i>Aesculus x carnea</i> Hayne ¹
<i>Populus x canescens</i> Sm. ²	<i>Tilia cordata</i> Mill. ¹
<i>Populus nigra</i> L. ²	<i>Tilia tomentosa</i> Moench ¹
<i>Populus nigra</i> 'Italica' ²	<i>Tamarix tetrandra</i> Pall. ²
<i>Salix fragilis</i> L. ²	<i>Fraxinus ornus</i> L. ¹
<i>Salix purpurea</i> L. ²	<i>Fraxinus excelsior</i> L. ¹
<i>Salix matsudana</i> Kodz. ²	<i>Fraxinus excelsior</i> 'Diversifolia' ¹
<i>Betula pendula</i> Roth. ^{1, 2}	<i>Fraxinus excelsior</i> 'Hessei' ¹
<i>Betula pendula</i> 'Dalecarlica' ²	<i>Fraxinus oxycarpa</i> Willd.
<i>Betula pendula</i> 'Purpurea' ²	<i>Forsythia x intermedia</i> Zab. ³
<i>Betula pendula</i> 'Youngii' ²	<i>Forsythia x intermedia</i> 'Spectabilis' ³
<i>Carpinus orientalis</i> Mill ^{1, 2}	<i>Forsythia x intermedia</i> 'Densiflora' ³
<i>Corilus avellana</i> L. ²	<i>Syringa vulgaris</i> L. ^{2, 3}
<i>Corilus avellana</i> 'Pendula' ²	<i>Elymus repens</i> (L.) Gould. ⁴
<i>Corilus avellana</i> 'Fuscorubra' ²	<i>Poa trivialis</i> L. ⁴
<i>Corilus avellana</i> 'Heterophylla' ²	<i>Arrhenatherum elatius</i> (L.) P. Beauv. ex J. & C. Presl. ⁴
<i>Quercus rubra</i> L. ^{1, 2}	<i>Lolium perenne</i> L. ⁴
<i>Celtis australis</i> L. ²	<i>Agrostis alba</i> L. ⁴
<i>Berberis vulgaris</i> L. ²	<i>Agrostis vulgaris</i> L.
<i>Berberis vulgaris</i> 'Atropurpurea' ²	<i>Cynosurus cristatus</i> L. ⁴
<i>Berberis thunbergii</i> DC ²	<i>Arrhenatherum elatius</i> P. B. ⁴
<i>Berberis thunbergii</i> 'Atropurpurea' ²	<i>Trifolium repens</i> L. ⁴
<i>Liriodendron tulipifera</i> L. ²	<i>Trifolium pratense</i> L. ⁴
<i>Mafnolia x soulangeana</i> Soul. - Bod. ²	<i>Lolium multiflorum</i> Lam. ⁴

Legend: ¹ - species used for tree/shrub groups; ² - species used for ornamental tree/shrub groups; ³ - species used for hedgerows; ⁴ - species used for grassing

CONCLUSIONS AND RECOMMENDATIONS

“Koriata” quarry is located on Fluvisols which are characterised by good physical properties. They are poor in SOM and TKN, but are rich in assimilable phosphorus and potassium.

There are statistically significant high ($> \pm 0.6$) correlations, for example: there is a negative correlation between bulk density on the one hand and SOM and nutrients on the other; there is a high correlation between total porosity on the one hand and SOM and nutrients on the other; there is a high correlation between the sand fraction on the one hand and SOM and nutrients on the other; there is a high negative correlation between the sand and clay fractions; there are high correlations between the clay fraction and SOM, TKN and K_2O .

Creating a park area instead of exploiting the resources of the sand and gravel quarry will not only have favourable benefits such as improved quality of life and health (which has been described by a number of authors [57; 58; 59; 60]), but will also result in at least a sevenfold increase in plant diversity and will meet the demand for themed water parks within the city limits of Sofia.

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ВЪЗМОЖНОСТИ ЗА ЛАНДШАФТНО УСТРОЙСТВО НА НАХОДИЩЕ НА ПЯСЪЦИ И ЧАКЪЛИ “КОРИЯТА”, СОФИЙСКО

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Резюме: В статията са представени резултати от ландшафтно планиране и изследване на почви от клас Fluvisols. Обект на изследване е находище на пясъци и чакъли “Корията”. Почвените проби са взети от 17 места в следните дълбочини: 0-20 см, 20-40 см, 40-60 см, 60-80 см, и 80-100 см. Установени са статистически значими корелации в 40 от 48 случая. Установени са статистически значими, високи ($> \pm 0.6$) корелационни зависимости като обемната плътност е в обратна корелация със SOM и хранителните елементи, общата порьозност се намира във високи корелационни отношения със SOM и хранителните елементи. Високи са зависимостите между глинестата фракция и SOM, TKN и K_2O .

Ландшафтното планиране на територията на находище “Корията” ще подобри качеството на живот и здравето на хората. Растителното разнообразие ще се повиши над седем пъти и ще отговори на нуждите на хората от тематични водни паркове в границите на град София

Ключови думи: ландшафтно планиране, Fluvisols, кариера, физични свойства, химични свойства, зелена система.

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